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## SECTION 1000.00 – STRUCTURE

### SECTION 1010.00 – GENERAL

The Bridge Design Manual provides guidelines and standard details that are workable, serviceable, and reasonably economical. In addition, these guidelines and details have been approved by FHWA for general use. Any departure or deviation from these guidelines and standard details in the Bridge Manual will require prior approval, and may result in delay caused by obtaining approval.

All new bridges that carry traffic on Interstate Highways and Ramps or US and State Highways shall be designed using the AASHTO LRFD Specifications and the guidelines in the Bridge Manual unless otherwise approved by the Bridge Engineer.

All rehabilitation, widening and modification to existing structures may use the AASHTO Standard Specification of Highway Bridges-17th Edition or the AASHTO LRFD specification if it is economically feasible.

Local and Off-System bridges should be designed using preferably the AASHTO LRFD Specification. AASHTO Standard Specification of Highway Bridges-17th Edition may also be used.

### SECTION 1020.00 – DESIGN STANDARDS.

**1020.01 Culvert vs. Bridge Designation.** To determine whether a structure should be designated as a Culvert or a Bridges, the structures shall be measured along the centerline of roadway from the inside face of wall or abutment. If the measured length is 20 feet or less it shall be designated a culvert, if greater than 20 feet it shall be designated a bridge.

**1020.02 Hydraulics.** All bridges shall have an [ITD 210](#), Hydraulic Structures Survey, approved by the Hydraulics Engineer. All culverts that require a diameter equal to or greater than 5 feet shall have an [ITD 210](#), Hydraulic Structures Survey, approved by the Hydraulics Engineer.

### 1020.03 WATERWAY CLEARANCES

**A. Bridges.** Structures with spans 20' or more, the minimum clearance above Q50 high water shall be 2'-0". In addition, the 100-year flood (Q100) must also pass beneath the bridge.

**B. Culverts.** Box culverts, pipes, and pipe arches with a clear span of 12' or more and all stiff-leg culverts and open bottom pipes, the minimum clearance above Q50 high water shall be 1'-0". When debris is carried by the waterway during high water flow, a minimum clearance of 2' should be considered. In addition, the 100-year flood (Q100) must also pass beneath the bridge.

For pipes, pipe arches, and box culverts with a clear span less than 12' , the ration of the headwater to diameter during Q25 flow should be equal to or less than 1.25 ( $HW/D < 1.25$ ). When debris is carried by the waterway during high water flow, a minimum clearance of 2' should be considered.

**1020.04 Structure Width.** The recommended width between the rail faces on the bridge will include the full approach roadway width plus shy distances shown in the Bridge Design Manual. The shy distances allow the face of bridge rail to align to the face of the roadway rail.

**1020.05 Canal Crossings.** Structures crossing canals are subject to canal company approval. The canal company should approve the Situation and Layout sheets sent to the District.

**1020.06 Foundation Data.** Refer to the Materials Manual. An approved Phase 4 Foundation Investigation Report is required for all bridges and culverts. The foundation plat is included in the structure plans.

**1020.07 Highway Vertical Clearance.** The recommended minimum vertical clearance on the State Highway System is 17 feet or Local and Off-System routes the minimum value is 16 feet. These clearances may be reduced with prior approval from the Roadway Design Engineer, DMV Port of Entry Manager, and Bridge Engineer.

Bridges carrying the railroad over the highway, the vertical clearances for highway crossings shall apply.

Bridges carrying the highway over the railroad, the minimum vertical clearance shall be 23'-0" from the top of the rail at a point directly over the centerline of the track.

**1020.08 Vertical Alignment.** A minimum slope is necessary for drainage. Vertical curves, if necessary can be accommodated. Sag vertical curves cause drainage problems if the low point is on the bridge.

**1020.09 Horizontal Alignment.** Avoid the use of spirals, variable crown super elevation runoffs and flares on bridges. While these are not impossible design problems, they do cause problems in construction.

**1020.10 Structure Depth.** Allowance for adequate structure depth should be made when establishing the profile grade. Contact the Bridge Section for approximate structure depth.

**1020.11 Deck Drainage.** Deck drains should be eliminated and the runoff should be taken by roadway drains beyond the end of the bridge, if possible. The Bridge Manual contains the criteria for determining the need for deck drains.

**1020.12 Bridge Rail.** Approved standard rail types and selection criteria are listed in the Bridge Manual. Pedestrian walkways shall be separated from the adjacent roadway by a traffic railing or combination railing when the posted speed is 50 mph or more.

**1020.13 Skew.** The skew angle is the angle measured from the perpendicular to the roadway centerline to the centerline of the bridge or culvert. Skew angles should be minimized and skew angles greater than 25° cause design problems. Snow plows have a fixed blade angle between 28° - 35° (left-forward). To minimize the possibility of having a snowplow blade drop into a joint, joint skews between 25° - 38° (left-forward) should be avoided.

## **SECTION 1030.00 – STRUCTURE SUBMITTAL DATA**

**1030.01 Structure Field Data.** The District or consultant will obtain the necessary field data for all major structures and for all drainage structures requiring structural design or detailing. The District Design section or consultant will send this data to the Roadway Design section for transmittal to the Bridge section, if the Bridge Section is designing the structure. The following field data is required in addition to the information on the Bridge Submittal Checklist for Situation/Layout.

- Cross sections of the existing channel at the roadway centerline and one bridge length upstream and downstream, as shown on ITD-210, Hydraulic Structure Survey.
- Cross section at the existing downstream toe of a roadway slope.
- Cross section of the existing bridge at the downstream edge.
- Cross sections of the existing channel at various locations to compute water surface profile through the bridge
- Natural stream cross sections of any limiting feature immediately downstream that controls the water surface (such as a riffle at the end of a pool).
- Natural ground cross sections for at least 200 feet on each side of the centerline junction or to the station showing the change in grade at the end of the structure.
- Cross sections of any proposed channel changes along with a grade line and alignment of the proposed channel. Highway alignment, typical sections, and centerline profile must be included for the highway carried by the structure.

A contour map of the bridge site shall be furnished showing 1 foot contour intervals to a scale that will allow the structure to be shown on a standard 11"x17" sheet. However, the scale shall not be smaller than 500:1.

#### **1030.02 Situation Layout Check List.**

Refer to [Bridge Submittal Checklist for Situation/Layout](#).

## **SECTION 1040.00 – CONSULTANT PREPARED BRIDGE PLANS & SPECIFICATIONS**

### **1040.01 Submittal Procedure.**

#### **Local Sponsor Projects**

Sponsors shall make all submittals to the LHTAC (Local Highway Technical Assistance Council), and they will make distribution to the necessary ITD Sections for review. Two copies of the Drawings should be submitted in 11"x17" format. Returned transmittals by the Bridge Section will be sent to the Roadway Design Area Engineer. This procedure is to be used on all projects to include Local Public Agencies (LPA) projects by consultants.

#### **State Consultant Projects**

Consultants shall make all submittals to the District Design Section, and the District will make distribution to the necessary ITD Sections for review. Two copies of the Drawings should be submitted 11"x17" format. Returned transmittals by the Bridge Section will be sent to the Roadway Design Area Engineer.

#### **Structure Concept Review**

A submittal of data is to be made showing the concepts of the project in general. Drilling for the foundation investigation for multi-span structures should be delayed until the concept is approved. The data should include:

- Bridge layout showing plan and elevation views
- Bridge cross-section
- Roadway cross-section
- Stream cross-section,
- Vicinity map
- Preliminary profile grade
- Draft Phase 4 Foundation Report (if available)
- Draft [ITD 210](#) hydraulic report
- Other data pertinent to type or location selection

Show as much of the above data as possible on the layout drawing.

Consultants are encouraged to contact the Bridge Section during development of the structure concept.

**Final Situation and Layout Review**

The plans shall consist of the following:

- Situation and layout
- Foundation investigation sheet
- Sketches or views of unusual structural details

Refer to the Situation and Layout Checklist in the Bridge Manual.

The plans should also be accompanied by:

- Approved Phase 4 Foundation Report
- Approved [ITD 210](#) Hydraulic Report
- Approved [ITD 757](#) Design Standards form
- District approved roadway profile and alignment data
- Topographic map with contours

The Bridge Section shall approve the Situation and Layout plans before proceeding with final design.

**Intermediate Design Reviews**

If needed, these reviews can be handled informally between the Local Public Agency/State Consultant and the Bridge Section.

**Final Design Review**

The submittal should include the following:

- Drawings in reproducible form
- Special Provisions
- Cost Estimate
- Quantity Calculations
- Construction Schedule
- Design Calculations

**Plans, Specifications & Estimates Submittal**

After the consultant has made the necessary corrections from the Final Design Review, the final drawings and the revised final design data shall be submitted.

The final drawings shall include the following:

- 22"x 34" 3 mil mylar stamped by the Engineer
- 11"x17" prints
- Electronic CADD files in .dgn format

The 11"x17" prints should preferably be either photographically reduced or have an electronic stamp.

The Bridge Section will publish a PS&E letter of acceptance.

In the transmittal letter for Local Sponsor Projects, the Bridge Section will include an estimate of man-hours for checking shop plans and construction drawings. The District will arrange for a supplemental engineering agreement to cover this additional work.

**1040.02 Review Procedure.** Consultants are used on state bridge projects when the workload exceeds the capacity of the Bridge Section or when special expertise is required. Counties and cities also frequently use Consultants to design bridges for LPA projects with Federal Aid funds.

A Bridge Section Engineer will be assigned when a new bridge design project is provided to the consultant. The reviewing engineer should have experience in the design of structures similar to the one to be reviewed. The Review Engineer will then become the contact for technical questions raised by the consultant throughout the design phase. This communication allows early identification of critical design areas and reduces the chances of major revisions.

The Review Engineer will not generally perform an exhaustive check on the design. All details, plans, and related work will be reviewed to ensure conformance with the criteria that follows.

The consultant shall apply his own seal and signature to the plans, and thereby assumes full responsibility for their correctness and general conformance with good engineering practice.

The following indicates the degree and type of checking to be performed by the Bridge Section:

**Structure Concept Study Review**

All concept studies will be thoroughly reviewed to ensure adequate evaluation of:

- Structure types that are compatible to the site conditions
- Preliminary cost estimates
- Advantages/disadvantages of each structure type
- Economy, feasibility, and constructability
- Structure types recommended for additional study or final design

A review of the bridge layouts will be made to ensure that span lengths, clearances, and all site conditions are adequately addressed.

**Final Situation and Layout**

Plans should be thoroughly checked by using the checklist located in the Bridge Design Manual (*BDM*). Conformance of grades, alignments, and other data between roadway and bridge plans should be checked.

The hydraulic and foundation criteria shown on the plans shall conform to the approved [ITD 210](#) hydraulic report and approved Phase 4 foundation report.

**Final Design Review**

Plans should be reviewed for completeness, constructability, compliance with current ITD standards, and good engineering practices.

A review of major structural elements should be performed. However, no stress analysis is generally required unless the detail appears questionable.

Pay items and Special Provisions should be reviewed for conformance with the Standard Specifications. Quantity calculations and rebar schedules are generally not checked in detail.

Design calculations shall be on 8 1/2"x11" paper with a proper heading, placed a binder with an index and stamped.

**Final Plan Review**

Plans will be checked for all changes required by the Final Design Review.

The signature, date and Idaho seal of a registered engineer of the consulting firm shall be on each drawing.